Karlsruher Institut für Technologie

Institut für Biomedizinische Technik

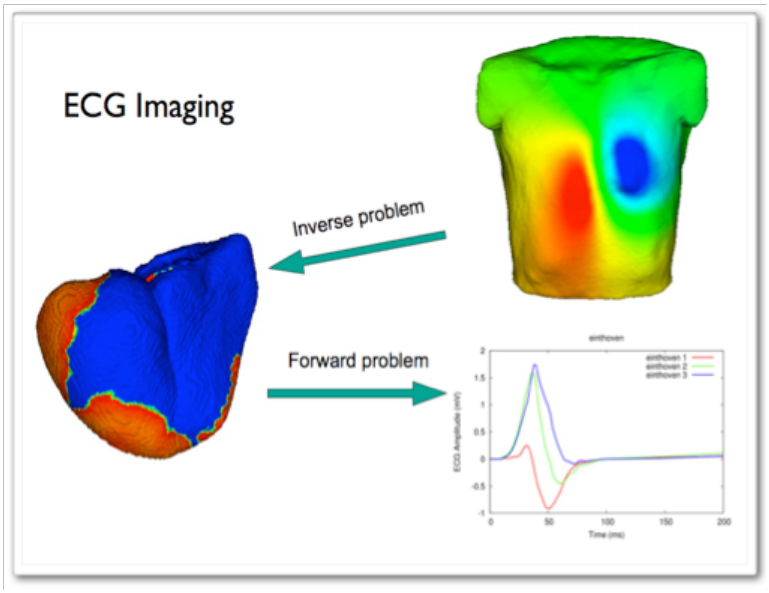
Master Thesis

Spatio-Temporal Optimization Approaches to the Transmembrane Potential Based Inverse Problem of ECG

Motivation

The goal of ECG imaging is the reconstruction of caridac electrical sources from the BSPM (body surface potential maps). The tool could have a great clinical potential by providing a cardiologist the quantitative information about the heart condition, thereby enabling pre-interventional planning and facilitating the intervention procedures themselves.

With the knowledge about model geometry, a linear relationship between heart sources and BSPM can be established. The problem is however severely ill-posed, i.e. it is very sensitive to the measurement and modeling errors. Therefore a special mathematical technique, called regularization, should be applied in order to get a stable solution.



Tasks

In the project new physiologically based approaches to the problem will be developed. In order to overcome the smoothness of a standard Tikhonov solution binary and ternary optimization techniques will be tested for extrasystoles and ischemia regions identification. Furthemore a new spatio-temporal function template of transmembrane voltages will be constructed: at each time step the corresponding functional will be minimized, thus delivering maximum-likelihood estimates for the unknown parameters.

Requirements

- programming skills in C++, MATLAB
- linear algebra, analysis
- some knowledge about optimization and/or cardiac physiology would be a plus

Field of Research

Inverse problem of ECG, Improvement of IP solution by imposing additional spatio-temporal constraints

Projects

DFG / Forward and inverse problems of electrocardiography

Areas

Optimization
Software programming
Algorithmics

Field of Studies

Mathematics
Electrical engineering
Computer science

Starting Date

from January 2013

Contact

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